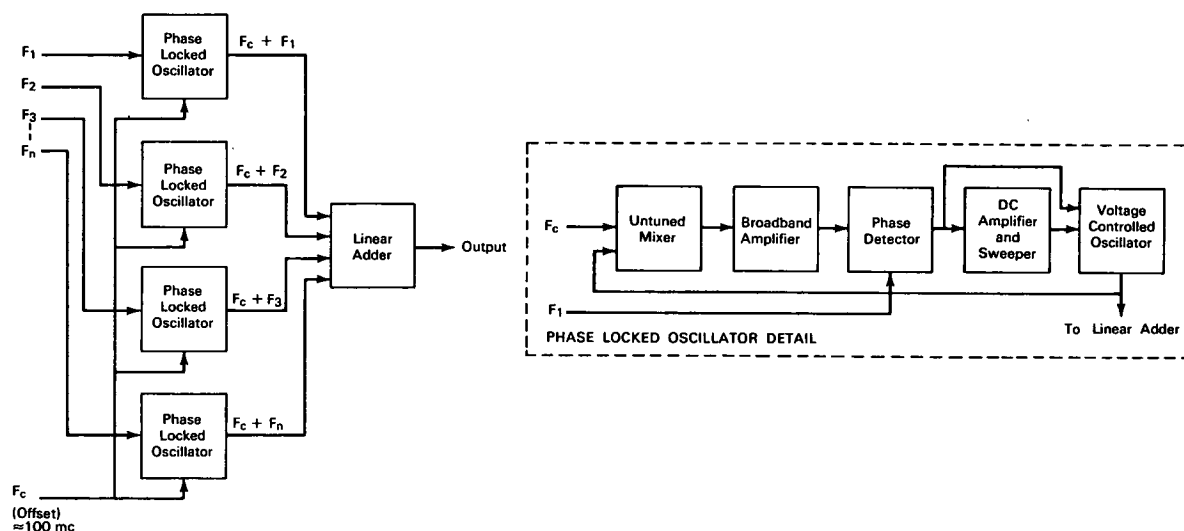


# NASA TECH BRIEF



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## Single-Sideband Modulator Accurately Reproduces Phase Information in 2-Mc Signals



### The problem:

In the process of generating a delayed signal for a multitone ranging system, it was necessary to single-sideband modulate a series of tones at approximately 2 Mc on a  $100 \pm 0.5$  Mc carrier. A 60 db rejection of unwanted modulation products and accurate reproduction of phase information contained in the 2 Mc tones were required together with accurate amplitude control of the relative components. A conventional single-sideband modulator system did not meet these requirements. Because of the center frequency range, it was not considered practicable to provide matched filters in the conventional circuit to ensure adequate rejection of unwanted frequencies.

### The solution:

A phase-locked oscillator system employing solid state components.

### How it's done:

The desired output frequency is generated by voltage-controlled oscillators operated in a phase-locked loop. Adequate isolation is ensured by decoupling of the mixer from both the offset carrier and the oscillator output. The mixer, 2 Mc amplifier, and phase detector are untuned circuits whose bandwidths ensure a negligible or essentially stable phase shift at operating frequency. A sufficiently high amplifier gain is used so that a control voltage for tuning the

(continued overleaf)

oscillator over a frequency range equal to that produced by thermal drift requires only 2 to 3 degrees of phase error. Thermal drift of the dc amplifier is minimized by temperature compensation, and the phase detector diode contact potential is rendered negligible by operation at an appropriate level.

**Notes:**

1. This system would be useful in telemetry, aircraft communications and position-finding stations, and VHF test circuitry.

2. Inquiries concerning this invention may be directed to:

Technology Utilization Officer  
Marshall Space Flight Center  
Huntsville, Alabama 35812  
Reference: B66-10437

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

Source: Harry F. Strenglein  
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under contract to  
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